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Strategic issues facing the development of Clean Development Mechanism Projects in South Africa

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Abstract

The Kyoto Protocol was signed into existence in 1999 in an effort to lower carbon emissions emitted around the globe. Under the protocol, a mechanism called the CDM was created in order to help developing nations, such as South Africa, lower their carbon emissions. This paper looks at the development of the carbon credits market in South Africa which was created by CDM. Since the ratification of the agreement thousands of projects have been registered by emerging countries such as India, China and Brazil, yet South Africa has only seventeen registered projects. As the largest economy in Africa, which accounts for the majority of the continent's emissions, the slow uptake of CDM projects is glaring. This research paper examines the strategic issues facing CDM projects in South Africa. The lack of skills in SA; the effect of Eskom's monopoly; the financing of the projects and the effect of government policies were posed in detail interview questions to key participants in the CDM market. Market participants cited the effect of an Eskom monopoly; the bureaucracy of the UN IPCC; and the lack of entrepreneurs in the sector as some of the main inhibitors to the growth of CDM in South Africa. The lack of skills in South Africa; the national government; and the effects of accounting and tax regulation were not cited as critical issues facing CDM projects. The results also indicated that the South African government could do more in providing funding for smaller projects and encouraging small scale CDM projects. In addition, many projects did not use debt funding to finance the project. The use of debt financing was identified as an area in which CDM projects could improve the returns achieved. While barriers exist for CDM projects in South Africa, South Africa does have the infrastructure and the potential to implement more CDM projects.

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Declaration

I, Arun Thomas Varughese, declare that this research report is my own, unaided work. It is submitted in fulfilment of the requirements for the degree of Master of Commerce in Finance at the University of Cape Town. It has not been submitted before for any degree or examination in this or any other university

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List of Abbreviations

"CCX"	Chicago Climate Exchange
"CDM"	Clean Development Mechanism
"CDM ICI"	CDM Investment Climate Index
"CER"	Certified emissions reductions
"CH_4"	Methane
"CO_2"	Carbon Dioxide
"DEAT"	Department of Environmental Affairs and Tourism
"DNA"	Designated National Authority
"DMR"	Department of Mineral Resources
"DOE"	Designated Operational Entity
"DTI"	Department of Trade and Industry
"EB"	Executive board of the UNFCCC
"ECX"	European Climate Exchange
"ERU"	Emissions Reduction Units
"EU"	European Union
"EUAs"	EU allowances
"EU ETS"	European Union Emissions Trading Scheme
"GDP"	Gross Domestic Product
"GHG"	Green House Gas
"HFCs"	Hydrofluorocarbons
"IDC"	Industrial Development Corporation
"IFRS"	International Financial Reporting Standards
"IPCC"	Intergovernmental Panel on Climate Change
"IPE"	International Petroleum Exchange
"IRR"	Internal Rate of Return
"Land Bank"	Land and Agricultural Development Bank of South Africa
"LTMS"	Long Term Mitigation Scenario
"MYPD"	Multi Year Price Determination
"NPV"	Net Present Value
"NERSA"	National Energy Regulator of South Africa

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"NO_2"	Nitrous Oxide
"PFCs"	Perfluorocarbons
"SARS"	South African Revenue Service
"SF_6"	Sulphur Hexafluoride
"R"	South African Rand
"UN"	United Nations
"UNFCCC"	United Nations Framework Convention on Climate Change
"US"	United States of America
"USD"	United States Dollar

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Introduction

Climate Change

Climate change has been described as the biggest challenge facing humanity in the 21st century. Over the past century, human activity on earth has increased exponentially and this has been linked to be the cause of considerable change to the natural environment. The ambient balance of the ecosystem has been altered through the depletion of natural resources and the burning of carbon fuels.

CO_2 levels have increased by over 30% since the Industrial Revolution (Reay and Pidwirny, 2006). The 2008 United Nations Millennium reports that the growth in emission between 2000 and 2005 has exceeded the growth in the previous decade (UN, 2008). The South African Weather Service predicts that the mean air temperature of South Africa will increase by 2 degrees in the next century (Weather South Africa, 2009).

Even a small increase of 5% to 6% in the global temperature levels can have a major impact on the environment and the way we continue to live on this planet. Climate change increases the probability of disasters such as hurricanes, tsunamis, changes in rainfall and rising sea levels which has an effect on human populations around the globe. Apart from the impact on mankind there is also an impact on the sensitive ecosystems around the world. A slight change in the ecosystem that occurs over a relatively short period such as a few decades has the potential to wipe out many species of plant and animal life. This also has a knock on effect on human activities such as farming and fishing.

Greenhouse gases comprise mainly of the following gases: CO_2, CH_4, NO_2, HFCs, PFCs and SF_6. GHGs, while occurring naturally in the environment, have increased dramatically over the past century due to human activity. The main contributors to increasing levels of GHGs are the burning of fossil fuels, industrial processes, transportation, agriculture and deforestation.

While critics may be at loggerheads as to whether human interaction with the natural environment is causing climate change, the general consensus is that nations throughout the world must work together in order to reduce their emissions baseline. While this is a principle that many may agree upon in theory, implementation in the real world, where the laws of economics and politics compete, has proven to be difficult.

Kyoto Protocol

The UN has been a key driver of the global movement for the reduction of GHGs in the atmosphere. The IPCC is its key body which facilitates research into global warming and combative measures.

The Kyoto Protocol was signed into action on the 11th of December 1997 but was only ratified in late 2005 by the majority of the signatories. Article 3 of the protocol specifies that countries specified in Annexure 1 of the protocol are required to reduce their national emissions to a minimum of 5% of their 1990 emissions levels. The commitment period

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specified by the protocol was between 2008 and 2012, in which Annexure 1 countries were obliged to have reduced their emission levels (UNFCCC, 1997). The protocol was pioneered by the IPCC which was first established to tackle the issues of climate change in 1988. Developed nations finally committed to reducing their emissions at the Kyoto Protocol, with the notable exception of a few countries such as the US. Developing nations such as China, Russia, India, Brazil and South Africa were exempted for the reductions targets.

Other climate change legislation that has been implemented includes the Montreal Protocol which was signed into agreement on the 16th September 1987 in order to combat substances which depleted the ozone layer and the acid rain program (under the 1990 US Clean Air Act). The legislation was instituted in the US to specifically combat the effects of SO_2 and NO_2 emissions (Ellis and Karousakis, 2009). The Kyoto Protocol is the first global agreement to tackle the issue of climate change.

Under the Kyoto Protocol three mechanisms were developed for Annexure 1 countries to meet their specified emissions targets, namely International Emissions Trading, Joint Implementation and the CDM.

International Emissions Trading: This mechanism allows Annexure 1 countries to trade 'emissions units' between each other. Under this cap and trade mechanism, countries that were projected not to meet their required emissions target could purchase emission units from countries who are below their allowed quota. As such, countries that reduced their emissions could gain financially. The EU ETS that began in 2005 was developed from the standards set by the US Clean Air Act amendments of 1990 which were brought about to curb the acid rain pollution in the US (Barone, 2008).

Joint Implementation: This allows Annexure 1 countries to invest in projects in other industrialized nations that offset emissions and then claim these emission units as a reduction towards their own emissions target.

The Clean Development Mechanism

Throughout history, countries that have industrialised have grown significantly and developed into the most wealthiest and prosperous of the present global community. Developing nations have emphasised their growth plans through increased industrialisation, which has been historically spurred through the use of fossil fuels, and initially refused to agree to emissions caps in order to protect their path to becoming industrialised. This was a stumbling block in negotiations for any agreement on global emissions control. The CDM was a compromise reached by the various Kyoto Protocol signatories. Under the Kyoto Protocol, developing countries were not set specific emissions targets but were encouraged to engage in more sustainable practices through the CDM. Under the auspices of the protocol, Annexure 1 countries (developed nations) are able to meet their emissions targets by purchasing credits from Non- Annexure 1 countries (developing nations). The cash flows from the sale of these credits is meant to support the adoption of clean technologies that reduce the carbon footprint of developing nations and allow them to follow a greener development path than one followed by existing industrialised nations. Article 12 of the Kyoto Protocol defines the CDM and outlines the implementation of process across the globe.

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The CDM offers industrialized nations an opportunity to meet their GHG emissions targets by engaging in GHG reduction projects in developing nations. Developing nations are incentivized by the CDM to develop new technology, encourage foreign investment and, in essence, encourage their own economic growth through the sale of CER credits (Lotz, 2009). The developed nation would then earn credits based on the difference between the baseline emissions that would have occurred had the project not been undertaken and the emissions of the current project (Victor and Cullenwood, 2007).

Two main objectives of CDM (Lotz, 2009):

1. Lower GHGs in the atmosphere by creating a tradable commodity for proven emissions.
2. Contribute towards the sustainable development of the developing nation hosting the project.

A CER is defined as prevention of the emission of 1 tonne of CO_2 or equivalent gas from being emitted. While CO_2 is the most abundant gas in the atmosphere and the GHG most released by human activities, there are other gases which contribute toward global climate change. The abundance of these other gases such as CH_4, NO_2, HFCs, PFCs and SF_6 are measured in CO_2 equivalents. However, the GHG potential of each of these gases is different. For example, the CDM considers the GHG potential of CH_4 to be 21, which implies that for the purposes of CDM 1 tonne of CH_4 is 21 tonnes of CO_2. CDM is governed by the EB of the UNFCCC and, as such, each CER generated must be approved by the EB. The EB also approves the methodology under which the CERs are generated in order to help maintain the integrity of the carbon reductions.

The South African Context

South Africa, along with other emerging countries, was exempted under the Kyoto Protocol and thus stands to benefit from capital inflows for CERs and investment in more efficient technologies. The conditions surrounding the market for CDM projects can have a major impact on its success.

The economy on the continent of Africa has been dismal since the majority of countries gained independence from their colonial masters in the middle of the 19th century. African countries in general lag not only developed nations but also their counterpart developing nations globally. The life expectancy in Africa is 45.2 years on average, which is poor compared to other developing nations around the global who have an average of 57.3 years. When examining the average growth in GDP, the average in Africa is a meagre 0.5% while global peer countries have an average growth in GDP of 1.7% (Collier and Gunning, 1999). The authors have highlighted reasons such as the geographic conditions inherent in the continent; the low quality of soil to be cultivated; low population density and its colonial heritage as the main reasons for its slow economic growth (Collier and Gunning, 1999).

South Africa has largely been an exception to the rest of Africa, showing substantial growth in GDP in the period since independence. This can largely be attributed to the large levels of mineral resources present in the country. This can, however, be misleading by the fact that

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South Africa has the largest inequality between the rich and poor of any nation on the globe as measured by the Gini Co-efficient (Christie and Gordon, 1992).

The country has undergone a dramatic change in political, social and economic structures since 1994 when the country was allowed to transition, without a violent episode, into a non-racially segregated country (Rodrik, 2006). The country transitioned into a democratic society and was able to re-enter the global markets after international sanctions were lifted. The new democratic government inherited a stagnant economy that had a fiscal deficit of 7% of GDP and an inflation rate of over 10% (Hodge, 2009). In the economic period after the 1994 elections the country was growing at unimpressive rates of 2.6% indicating that the government's efforts to promote growth using various programmes was unsuccessful. However, in the beginning of the next decade the government made a significant turnaround with the country recording constant growth rates and containing inflation within the 3% to 6% band. South Africa also turned around its fiscal deficit to its first fiscal surplus.

Despite the progress made by the government since independence, South Africa still struggles with a large level of unemployment, crime and poverty. A study by the Greater Johannesburg Metropolitan Council and the World Bank has identified crime, violence, labour regulations, exchange rates, corruption, the shortage of skills and taxes as the biggest constraints to business growth in South Africa (Fields, 2000). A large contributor to a few of these causes is the poverty created by the large level of unemployment. There have been suggestions that the conundrum of rising unemployment in the face of a growing economy cannot be attributed solely to the deficient demand or decline in aggregate labour absorption capacity of the economy (Hodge, 2009). Rather, the supply side and increased numbers in the labour force are noted as the real reasons for the conundrum. In the period from 1995 to 2007, employment in the formal sector grew by 32% but this was far below the 48% increase in the labour force (Hodge, 2009). A CDM project is, on a basic level, simply a capital project. Like any other capital project which requires investors to invest capital, resources and time in order to achieve a return; socio economic factors as pointed out above affect the investment decision and the returns achieved from the project.

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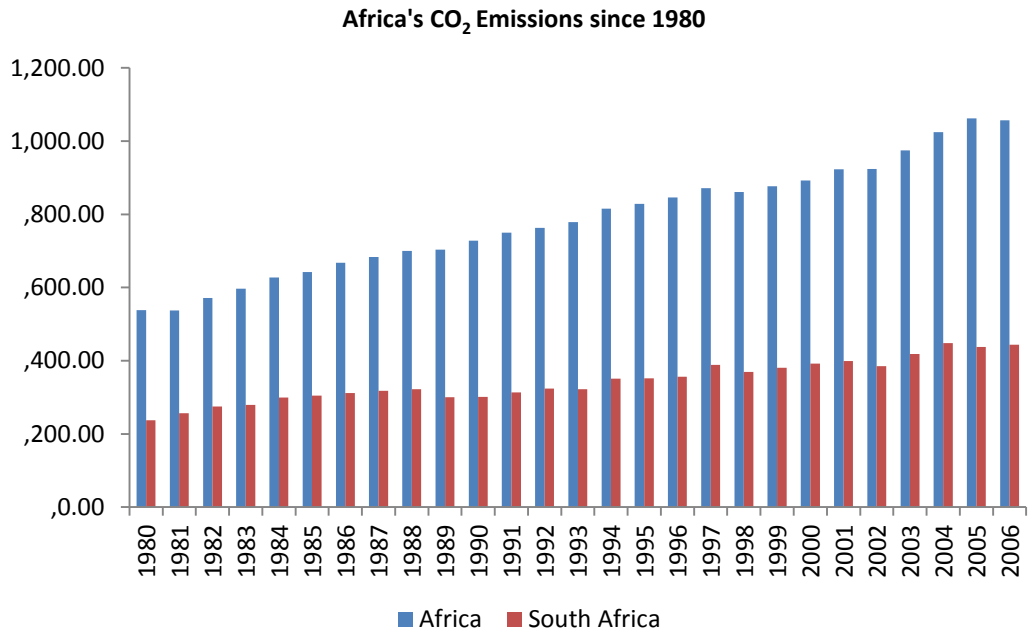
The case for CDM in South Africa

The UNFCC currently has 1,750 projects registered worldwide, with the majority of CDM projects registered in China. South Africa, however, has only seventeen projects registered at this stage, while Africa as a whole only has less than 2% of the total CDM projects registered. As can be observed from Figure 3, Africa's CO2 emissions have been steadily increasing since 1980. This presents an opportunity for Africa to get involved in sustainable development and to benefit from the CDM. The graph also indicates that of the total emissions of the African continent, South Africa accounts for over 40% of the total emissions. As Annexure 1 countries are working toward lowering their emissions, there is significant demand from developed nations for CERs. As such, the demand for CERs should be the driving factor for CDM projects in South Africa.

Figure 3



Source: United Nations, 2009

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There are further reasons why South Africa is well suited to implement CDM projects. The industrial users of energy in South Africa consume over 40% of all power in South Africa (DME, 2005). South Africa has the 26th highest GDP in the world in 2001 yet is ranked 16th in the world in terms of consuming energy (Winkler and Van Es, 2007). Clearly there are large gains in efficiency that could possibly be made. The high level of energy use in South Africa coupled with the high prices of commodities indicates that energy efficiency will be a priority for all users of energy in the future. Furthermore, the laws and regulations of the country may indeed change to adopt a more stringent line with regard to energy usage. The DMR has set a 15% reduction target by 2015 (Winkler and Van Es, 2007). This presents opportunity for South Africa to adopt energy efficiency CDM projects.

Studies abroad have shown that demand for CDM projects globally has been high. The Point Carbon survey of 3,319 respondents found 41% of companies involved in CDM expected to increase their carbon credit project investments in 2009. This is an indicator that despite the global recession, growth in the CDM market is still on the increase. Another indicator to support the positive outlook for the market is in the forward sales of CERs. Over 20% of respondents have traded CER forward contracts are for post 2012 delivery, which was a substantial increase from the 8% of respondents in the 2008 survey (Point Carbon, 2009). This global demand is again a positive driver for potential projects in South Africa.

The Deutsche Investitions (Deutsche Investitions, 2009) has developed an index called the CDM ICI which measures investment climate for CDM projects in a country. The index is based on a scale of 0 to 100 points. South Africa is currently ranked the highest in Africa with 76.4 points. The report cites South Africa's good ratings for the general investment

climate and corruption indexes as a key reason for being rated as the best country in Africa to conduct CDM projects (Ehlers and Wiekert, 2006).

As indicated above, South Africa has its fair share of troubles facing many emerging countries. However, the stage has been set for South Africa to partake in the CDM global market. South Africa is the largest industrial consumer on the continent of Africa and produces a large amount of the continent's carbon emissions. Furthermore, with strong global demand, the conditions are ripe for South Africa to capture its share of the global CER market. However, the slow uptake of projects in South Africa points to strategic issues facing the CDM market in South Africa. This paper seeks to identify these issues and understand why South Africa lags in this market.

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Literature Review

While a large amount of research has been done on the Kyoto Protocol internationally, very little research has been done from a South African perspective. The following are key papers that support the key research question presented.

Economic theory has shown that for an externality such as carbon emissions the optimal point of reducing the level emissions is the point where the abatement costs are equal to the benefits derived from reducing emissions. However, no country has an incentive to reduce its GHGs below its non-co-operative level, which is defined as the business as usual levels of emissions, since the costs of abatement occur instantly but the benefits only arise in the future (Bohringer et al, 2003). Bohringer and Vogt discovered that market power in emissions trading might prevent the Kyoto Protocol from being reduced to a purely symbolic policy (Bohringer et al, 2003).

Currently there are two major exchanges that trade in CERs, the CCX and the ECX. The CCX is currently the only cap and trade system in North America. Interestingly, unlike in Europe where compliance with the Kyoto Protocol is mandatory, the CCX is a voluntary exchange where members enter into agreements to meet annual GHG emissions reduction targets. The reductions are verified by an independent third party, the Financial Industry Regulatory Authority.

The ECX was formed pursuant to a co-operative agreement between the CCX and London's IPE. However, market observers are sceptical about a global emissions trading scheme similar to the EU ETS. During the initial phase far too many EUAs were issued resulting in little incentive for companies to reduce their emissions targets (Petroleum Economist; 2008).

Hasselknippe (2003) describes the mechanisms of emissions trading. The CERs are priced according to supply and demand for a specific project (Lotz, 2008). CDM CER prices also appear to converge on prices based on the EU ETS prices (Victor et al, 2007). With the EU ETS being the largest carbon credits market in the world, there is enough liquidity in the market to allow the convergence of the prices across the three mechanisms outlined in the Kyoto Protocol. Due to a lack of an emissions target for South Africa and other emerging countries, a cap and trade system is currently not possible. As such, CDM is currently the only method for South Africa to enter the global carbon credits market. However, with growing demands from developed nations for developing nations to also reduce emissions this may well change in the future.

An authoritative paper was written by Little, Maxwell and Sutherland (2007) on accelerating the implementation of CDM in South Africa. The authors outlined the following factors as facilitating factors to the implementing of CDM in South Africa. The growing carbon credits market internationally is fueling demand for CERs from emerging markets. The authors also believed that there was sufficient infrastructure built in South Africa to facilitate the implementation of CDM projects. Furthermore, the authors point out that there is sufficient industrial capacity to warrant the CDM projects and there was sufficient government involvement to allow the CDM registration process to occur (Little et al, 2007).

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In addition to this, the above authors also identified the following factors that inhibit the implementation of CDM in South Africa. Firstly, the authors identifed that the UNFCCC requirements and processes were complex. The results of the research showed that the process was overly bereaucatic, the transaction costs were high and certain requirements such as additionality were vague. Secondly, the fact that the Kyoto Protocol was up for renewal in 2012 led to uncertainity as to whether the CDM will last beyond this period. Thirdly, the authors found that ineffective government procedures can hinder CDM implementation. The results of the survey found that additional governmental requirements added layers of procedures to the already complex CDM registration process. A major hinderance to the uptake of CDM in South Africa highlighted by the work performed was an investment barrier of low electricity costs maintained by the national electricity producer Eskom. Finally, the authors also noted the gap in communication between the government and the industry as an inhibiting factor (Little et al, 2007).

In their paper, Ganstho and Karani (2007) discovered that financial risks and lack of infrastructure inherent in Africa have hindered the growth of CDM projects by increasing the transaction costs. They also note that development financing institutions have a key role to play in promoting CDM projects and achieving the sustainble development invisioned in the Kyoto Protocol.

The lack of funding from financial institutions such as banks has been outlined by Usher and Touhami (2006), who point out that perceptions of the renewable energy sector and lack of information on the success of such projects has hampered the ability of project developers to obtain financing from the banks. The paper indicates that general training of staff at retail banks, technical support for specialised loan instruments and financial support in the form of interest subsidies are needed to encourage banks to provide funding to project developers.

Financial viability and sustainability of projects are assessed by the following (Yamba, 1998):

1. Profit/loss of the project
2. The balance sheet
3. The cash flow requirements
4. Financial indicators such as internal rate of return, net present value and payback period

A study by Gilbert (2003) into capital budgeting techniques used by South African firms revealed that the majority of companies do not use discounted cash flow methods such as NPV to evaluate capital investments. Secondly, when discounted cash flow methods were used they were used in conjunction with other capital budgeting methods. In research conducted by Brijal and Quesada (2009), it was shown that firms in the Western Cape, South Africa, employed capital budgeting techniques in choosing whether to invest in new projects. The research found that the payback period, net present value analysis and the internal rate of return were the most popular of techniques utilised. Over 64% of companies surveyed only used one capital budgeting technique, while 32% used between two and three different types of financial analysis to assess projects (Brijal and Quesada, 2009).

The effect of governmental involvement in the CDM process is a vital part of developing and registering projects with the EB. The DNA is a sub department with the DMR that was

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created to facilitate the registration and approval of CDM projects. The DNA was established under Section 25 of the National Environmental Management Act on the 24th December 2004 (DME, 2009). Under the Act, the DNA has been given the full legal authority to oversee the CDM registration process in South Africa as specified in Article 12 of the Kyoto Protocol (UNFCCC, 1997). Currently there are 102 DNAs around the world that are registered with the UNFCCC (Resende, 2008).

Resende (2008) identifies the goals of the DNA as the following:
1) Grant national approval and confirm the contribution of the project to sustainable development
2) Confirm project activity is voluntary

The CDM registration process in South Africa was reviewed by Lotz, Brent and Steyn (2009) in a research paper. Essentially, the process starts with the identification of a potential project by a project developer. The project developer then submits a Project Design Document ("PDD") that outlines how the project meets the requirement laid down by the Kyoto Protocol for CDM registration. This is submitted to the local government for approval. The government agency responsible for assessing the PDD is the DNA which is a sub department of the DMR in South Africa.

Once a CDM project has been approved by the DNA, it must be verified by an independent third party known as the DOE. The DOE is accredited by the EB to be an independent third party to the local government. After approval has been given by the DOE, the CDM PDD is sent to the EB for final approval. Once a project is approved and registered with the UNFCCC, there is an on-going verification process for all the credits generated by the CDM project. The on-going verification is performed by the DOE. Once the DOE is satisfied that all the conditions imposed on the CDM project have been fulfilled, the EB issues the CERs to the project developers.

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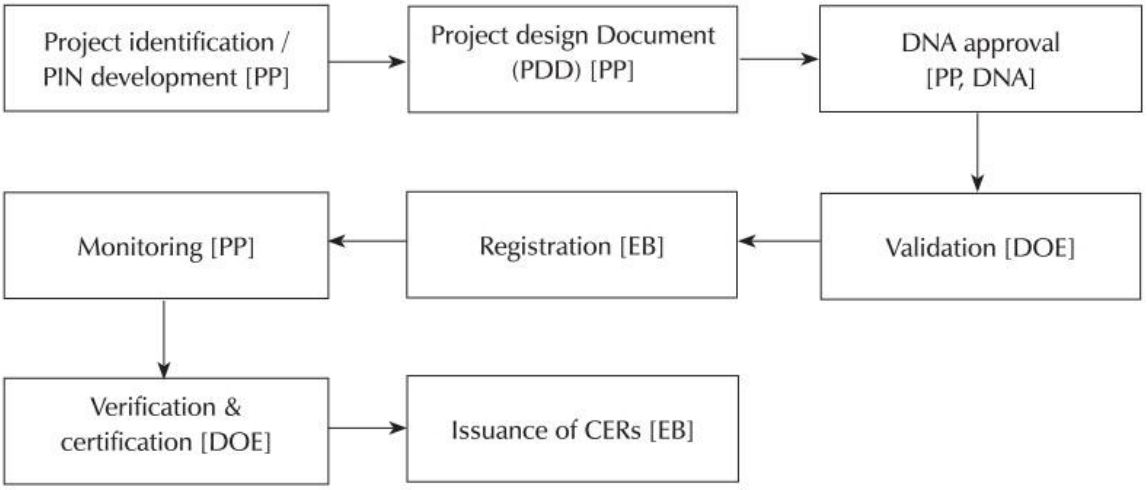
Figure 1

Flow diagram of CDM process and party involvement (adapted from UNDP, 2006)



PP – Project Proponent; DNA – Designated National Authority; DOE – Designated Operational Entity; EB – Executive Board

Reference: Addressing the need for a Clean Development Mechanism (CDM) specific project management strategy (Lotz, Brent and Steyn, 2009)

The Kyoto Protocol and the UNFCCC have committed to the CDM process through established methodologies. In other words, for a CDM project to qualify it must be in a certain sector of the economy and be involved in a certain activity. Below in Figure 2, in each defined sector the UNFCCC has outlined various activities that would qualify the project to register for CDM. While these methodologies have been outlined, the EB also accepts applications for new methodologies for the reduction of greenhouse emissions.

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Figure 2

Sector	Project/activity
Energy supply	Gas-fired power generation
	Cleaner-coal power generation technology
	Hydro-electricity to replace coal-fired power stations
	Co-generation (biomass or fossil-fuel based)
	Renewable electricity (e.g. wind, photovoltaics, biomass) and other renewable
	energy (e.g. biogas)
	Switch of synthetic fuel feedstock from coal to gas
	Use of forest and agricultural wastes to generate electricity and heat
Manufacturing	Conversion of boilers from coal to gas
	Industrial energy efficiency
	Structural change to less energy- and emissions -intensive industries
	Industrial energy efficiency
	Reducing methane emissions from coal mines
Mining	Control of coal dump fires
Agriculture and forestry	Afforestation and reforestation (during the first, 2008-2012, commitment period)
	Improved management of natural woodlands (not yet included in the CDM)
	Control of fires (not yet included in the CDM)
Transport and communications	Improved public transport
	Improved urban planning and traffic management
	Improved vehicle efficiency
	Vehicle fuel switching
	Switching from road to rail transport
Residential, commercial and government buildings	Energy-efficient appliances
	Solar water heating
	Fuel switching in households and commercial boilers
	Energy efficient building design
	Energy management

Reference: UNFCCC website, http://cdm.unfcc.int, accessed 22/05/2009

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In addition to the outlined sectors and methodologies only nuclear power plants are specifically excluded from the scope of CDM. As such, the operation of a nuclear power plant cannot qualify for CDM registration. The EB has noted that small scale renewable energy projects and energy efficiency projects are favoured in terms of methodologies (UNFCCC, 2009).

In addition to implementing a project that is in an accepted sector and has an approved methodology, the CDM project must also comply with two critical requirements known as Sustainable Development and Additionality. The Sustainable Development requirement notes that a CDM project must also contribute towards sustainable development for local communities where the CDM project is implemented. Due to the low level of development in South Africa and other African countries, sustainable development of low carbon projects have to be part of mitigation efforts (Winkler, 2005).

The Additionality criterion has been put in place to prevent "free rider" problem, where projects that would have occurred regardless of CDM would be eligible for CERs. In other words, projects that would have been funded and implemented regardless of revenue from carbon credits are disallowed from registration as a CDM project. This is currently a problem facing hydro powered CDM projects in China. Critics of CDM have argued that many of China's hydroelectric dams would have been built regardless of the introduction of CDM (CDM guidebook, 2004). China has been steadily increasing its power capacity over the years. There is considerable doubt whether these projects would never have been built without funding from CERs (Barone, 2008).

The capacity of the government to provide institutional, organisational and administrative infrastructure has been identified as a significant barrier to the development of CDM in the African continent (Spadling and Matibe, 1998). There is a prevailing argument that without this institutional structure in place it would be difficult for African countries to develop strategic plans to implement climate change projects on the continent. The creation and on-going development of these institutions is essential for the successful implementation of CDM in Africa (Sokona and Thomas, 1998).

The advantages of a well organised designated national authority have been outlined by Spalding and Matibe (Spalding et al; 1998) as follows:

- Define CDM goals and develop a climate change policy
- Integrate economic, environment and social policy with implementation of CDM
- Develop criteria and procedures for the approval of CDM projects in the country's context
- Engage with the private sector in identifying projects and disseminating information

The certification of the carbon credits of CERs has an impact on the viability of the projects. As the emissions reductions have to be verified by the DOE and the DNA, there is uncertainty regarding the recoverability of the investment in the CDM project. In a perfect situation the CERs generated should be transferred and verified periodically (Spadling et al, 1998). As credits are earned for each year of emissions reductions and the subsequent issuance of the CER, the timing of the verification affects when credits can be sold to investors. The sale of CERs at the beginning of a CDM project is riskier than the sale of CERs at the end of a period. Therefore, it is not ideal for investors to purchase credits at the beginning or end of a project (Spadling et al; 1998).

The lack of skills in South Africa has been highlighted by various researchers and is a problem that has been targeted by the South African government. The results of research by the Human Sciences Research council in 2003 has indicated that there is a high demand for high end skills such as engineering, science and academics. There has been a shift in the structure of the South African economy with the manufacturing sector shedding jobs over the past decade. The economy has a strong level of structural unemployment as employment in the manufacturing and agricultural sectors declined workers were not able to transfer their skills to the services and other high skilled sectors (Daniels, 2007).

The lack of co-operation between the various South African governmental divisions and the need for a more streamlined bureaucracy was highlighted (Daniels, 2007). During the days

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when South Africa was a non-democratic state, the state was a central player in developing industrial capabilities and the main driver of employment (Harshe, 1994). However, this attention was directly at a minority of the population, mainly the white population. In contrast, the black population was subjected to various discriminatory laws that prevented them from gaining prominence in the society and gaining skills, social class or wealth. The Apartheid government implemented systems such as an inferior education known as Bantu education to deliberately keep the black population uneducated. This created a distinct layering in the types of labour. A minority of the population is skilled and has a substantial portion of the wealth while the majority is impoverished and has little skills.

In order to address these problems, laws such as the Restitution Commission of Land Rights were implemented in order to address the legacy issues caused by Apartheid (Harshe, 1994). Under such laws and regulations, the aim was to redistribute the wealth held by the minority and to uplift the masses of poor people within the state. However, even after many years of political freedom, the majority of the population remains in poverty with the official unemployment rate exceeding 25% (Statssa, 2011). Due to the legacy of Apartheid, the country has a massive problem in a labour force that suffers from structural unemployment. The majority of the labour is employed in sectors such as mining and basic manufacturing industries, which require low levels of skills. There is only a limited amount of demand for South African labour in terms of exporting metals, alloys and precious stones (Fields; 2000).

The level of unskilled labour available in South Africa does not provide the country with a comparative advantage in the global economy as there are many emerging countries that have larger populations who can provide more unskilled labour. India and China both have populations of over one billion people each, in comparison to South Africa's forty million (Fields, 2000).

While the CDM has been hailed as a success on paper, the implementation of the mechanism has been heavily criticized. Opponents of CDM argue that the requirements for "Additionality" are not truly resulting in reductions of GHGs (Victor et al, 2007). As pointed out earlier, the CDM relies on estimating baseline emissions of "business as usual emissions". However, Golder and Nadreu (2002) pointed out the difficulty in identifying baseline emissions of host countries (Resende, 2008). They state that without emissions caps for developing nations, estimating accurate baseline emissions are not possible.

One example of perverse effects of the CDM is the projects designed to reduce HFC_{23} gas emissions. HFC_{23} gas is an emission produced in the manufacture of refrigerants, which is 12 000 times stronger than CO_2 in terms of the greenhouse effect and one third of CDM projects are dedicated to reducing this gas. However, many companies in developing nations are not installing technology that is cheap and easily accessible in order to have a high baseline values to create more CERs. The reduction of the gas globally garners up to $12, 2 billion from CERs but it would only have cost $136 million to install HFC_{23} removal equipment. A simpler method would be for developed nations to simply pay for the technology to be installed (Victor et al, 2009).

Carbon emissions are also not well quantified in business spheres or at a governmental level. Businesses are not required to use monitoring instrumentation; rather they are allowed to determine their carbon emissions by calculation. Even though these amounts are

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audited, they are still subject to possible manipulation (Barone, 2008). Secondly, the validity of the offsets is also questionable. The main idea behind the CDM process was to reduce emissions by one party and allow another party to continue emitting GHGs elsewhere. However, whether emissions have actually been reduced is questionable. Developers of projects have to show that the projects would not have come about had it not been for the cash flow from the sale of credits. Therefore, there is doubt whether the reductions are real.

McDougall and Zhang (1999) also points out three points of contention for the implementation of CDM. They comment that there is concern by observers of the ability of host nations to negotiate CDM contracts; a possible risk of early sell of the cheapest abatement projects; and political interference in the host countries economically and politically. McDougall and Zhang also infer that the CDM is a product of two political motives, namely the sustainable development of developing countries and cost minimization of abatement cost for industrialized nations. Differences in the motives of the industrialized nations and the developing nations could lead to the ineffective application of CDM.

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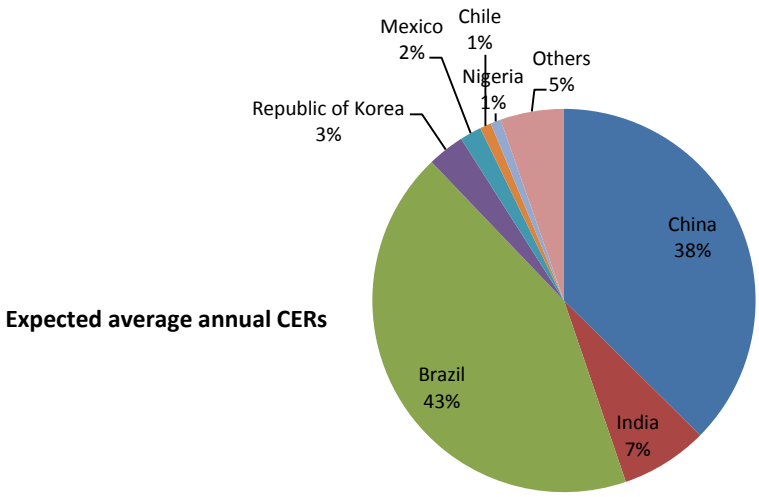
Research Question

The Kyoto Protocol was ratified in 2000 and was brought into effect in 2005. The global community in general was in support of reducing emissions across the globe and the culmination of this was the Kyoto Protocol. The Kyoto Protocol made specific provisions to help emerging nations grow on a greener path than industrialised nations. CERs under the Kyoto Protocol allow third world countries to implement energy efficient projects by providing a financial incentive. Over the past five years, countries such as China and India have registered over 60% of the total CDM projects around the world. Yet Africa and, more specifically, South Africa, has only yet managed to register a disappointing seventeen projects out of the thousands currently registered on the UNFCCC database. With the large reliance on fossil fuels in South Africa, it makes both environmental and economic sense to promote the use of cleaner energies. While countries such as Brazil, India and China have really exploited this opportunity; South Africa lags behind in this development.

Figure 4



Reference: UNFCCC website, http://cdm.unfcc.int, accessed 22/05/2009

A striking feature is the expected CERs expected from each developing nation that is party to the Kyoto Protocol. As indicated by the graph in Figure 4, the amount expected CERs generated by the African continent is minute. Africa accounts for less that 1% of the total CERs generated. The vast majority of CERs are generated by China (58.96%), India (11.58%) and Brazil (6.29%).

South Africa is the leading economy in Africa and produces a significant amount of the continent's GDP. While it may be the largest economy in Africa the country is plagued with problems of high unemployment, crime and poverty. The effectiveness of the South African government in implementing the Kyoto Protocol has been called into question, along with the effect of the lack of skills in the country. These factors have long been pointed out as being limiting factors for the country's growth. With positive global demand for CDM projects and the push for energy efficiency, the number of projects registered in South Africa should, in theory, be more in line with its emerging market peers.

While there is a great deal of technical research regarding the implementation of CDM projects in South Africa, there has been no focus on the overall development of the market. This market is still in its infancy and as such very little academic research has been performed on analysing the various strategic issues surrounding the development of CDM in South Africa. This paper takes a broad look at the market that has developed over the past five years, specifically the role of government involvement in developing the local CDM market through support structures and regulation; the ease of access to funding; the impact of the lack of skilled labour in the South African market; whether accounting and tax ambiguity of developing a CDM project was a hindrance; the ability of CDM project developers to sell their CERs; and what type of financial analysis was performed in evaluating whether to invest in CDM projects. The investigation of the above factors will allow for insight into the market and allow further research into specific areas in future.

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Research methodology and approach

The methodology for the research paper is a qualitative method of obtaining insight through interviews with key decision makers in the market, rigorous study of project documentation and the use of industry publications. This approach was undertaken due to the relative infancy of the carbon credits market in South Africa which has resulted in a lack of publically available information. As pointed out earlier, no in-depth research exists in the South African sphere regarding CDM projects from a financial perspective.

As the population of CDM and climate change practitioners is small, a target sample size of 15 – 20 responses was chosen. Detailed interviews lasting between 45 minutes and 1 hour were conducted. The interviews were conducted either in person or via a recorded telephonic conversation. As part of the University of Cape Town's ethical research standards, all participants were asked for their permission to conduct the interview and were guaranteed anonymity in the study. At the time of this research paper, only seventeen projects had been registered in South Africa and often more than one project had been registered by the same entity. Detailed interviews were held with over 90% of project participants, key government officials and top consultants in the field. Therefore, while the interview base is small, it covers the vast majority of the total population of individuals and entities operating in this field.

As pointed out earlier, due to the relative infancy of the market in South Africa, a qualitative approach was undertaken as the lack of publicly available financial information made it difficult to obtain a true understanding of the topic without conversing with the key players in the market. While all projects submitted their proposal documents to the UNFCCC, participants were required to disclose factors such their financing structure, expectations for the carbon price and the models used to evaluate the projects. Furthermore, due to the fact that the market in South Africa is relatively new with the first projects registered at the beginning of the decade, there was very little historic data to perform a suitable quantitative analysis. Therefore, a detail interview methodology where the majority of the key players in the market were interviewed was selected as the most optimal way of obtaining the best information to enable a meaningful study of the market.

The following types of people were interviewed for purposes of this study:

- CDM project managers
- Government officials from the DNA and the DTI
- DOEs
- Academics
- Tax and legal experts

A set of 20 questions were asked of market participants. Please refer to Annexure 3 for the list of questions asked to various participants. These questions were adapted for the different types of participant interviewed. In addition, further questions were asked when interesting topics needed further probing. While a target of 15- 20 participants was anticipated, interviews were conducted with 21 individuals.

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The questions asked were of a broad nature allowing project participants and key players in the market to elaborate on their opinions.

All registered projects are required by the UNFCCC to submit the project documentation to the UNFCCC public domain. This is a valuable source of information as the PDDs are quite detailed with disclosed information regarding the financing of the projects, the proposed methodology of implementation, and the amount of CER's projected. The PDDs of the registered projects in South Africa were all obtained, along with their appendices, and analysed to obtain information regarding the projects. Most importantly, as these were all successful projects that have since been registered, the PDDs provide a key insight into the factors that caused these projects to be successful.

The PDDs were used in conjunction with the project participant interviews to gain a further understanding of the market in South Africa. After careful study of the PDD for a particular project, the project manager was asked deeper questions regarding the project. A pioneer paper into CDM by Little, Maxwell and Sutherland (2007) utilized a qualitative approach using surveys and face to face interviews. A similar type of research methodology was followed by Lotz (2009) who used a combination of questionnaires and case studies. Tyler (2008) also used a combination of detailed interviews and documentation. While Lotz (2009) had an in depth look at project risk management regarding CDM projects and Tyler (2008) studied the use of real options in CDM projects in South Africa, this paper takes a broader look at the development of the market and its challenges. The use of detailed interviews in place of questionnaires allows the research to take a broader and open ended approach.

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Data and Research Findings

The results of the research conducted can be divided into two key areas. The first area is the finance questions posed. The financing of CDM projects was examined from a few different perspectives. The most important issues examined in the research work was the funding structure of the projects; the method of sale of the CERs generated; and the level of financial analysis used to assess the projects. These areas were identified as being key to the viability of the CDM projects with project participants and key players often citing issues within these areas.

In the second area of focus, the CDM market in South Africa was examined. The investment barriers present in the South African market that inhibit the uptake of CDM projects and the effect of the Eskom monopoly were proposed to key market participants. Another key research question addressed was the impact of the skills shortage in South Africa. The effect of the South African government and its DNA department was also examined in depth. Finally, the impact of the taxation and accounting rules on CDM projects was discussed.

Figure 5 below provides a summary of the CDM projects undertaken in South Africa. The table outlines the following key areas: the funding of the project; the type of financial analysis undertaken; the crediting period; the total credits to be received and the sector in which the CDM project was undertaken.

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Figure 5- Summary of South African Projects

Project	Funding	Evaluation Methodology	Location	Project activity	Period	Total Reduction	Annual Reduction
AECL-2	Equity	Cost Analysis	Johannesburg	Chemical Industry	10	1,167,790	116,779
AECL	Equity	Cost Analysis	Johannesburg	Chemical Industry	10	2,654,600	265,460
Alton Landfill	Equity	IRR Sensitivity analysis	Richards Bay	Waste Handling	10	258,927	25,893
Beatrix	Equity	IRR	Virginia	Mining	7	2,632,418	376,060
Bethlehem Hydro	Funding from DBSA	Unknown	Bethlehem	Renewable Energy	7	228,816	32,688
Durban Landfill	Equity	Unknown	Durban	Waste handling	7	2,398,935	342,705
Durban Landfill	Equity	Unknown	Durban	Waste handling	7	481,833	68,833
Envirserv	Equity	NPV IRR	Johannesburg	Waste Handling	7	1,318,732	188,390
Kanhym	Equity	NPV IRR Sensitivity analysis	Middleburg	Agricultural	7	228,622	32,660
Kuyasa	Unknown	Unknown	Cape Town	Energy Reduction	7		
Mondi	Equity	IRR	Richards Bay	Manufacturing	10	1,846,328	184,633
Lawley	Equity	NPV	Johannesburg	Manufacturing	10	191,590	19,159
PetroSA	Equity	NPV IRR	Mossel Bay	Renewable Energy	10	299,336	29,933
Rosselyn Brewery	Equity	NPV	Pretoria	Manufacturing	7	709,895	101,414
Star Diamonds	Equity	Unknown	Theunissen	Waste Handling	7	277,200	13,200
Transalloys	Equity	NPV IRR Sensitivity	Witbank	Metal Production	10	550,438	55,400
Tugela	Equity	Unknown	Mandini	Thermal Energy	7	379,004	54,143

Financial Analysis

Sale of CERs

CDM projects are developed with the aim of developing projects that reduce their carbon footprint through alternative energy sources or the lowering of energy usage. The reduction of the carbon footprint for projects ultimately results in CERs being issued for each ton of carbon that is saved. These CERs are the primary motivator for CDM in developing nations such as South Africa. That being said, the sale of the CERS is of paramount importance to CDM projects as it is the primary source of revenue for the project. Project participants were asked about the sale of their CERs and the method in which it was done.

Three options exist for South Africa project developers to monetise their cash flows:

1. Sale of CERs on the spot market once validation has occurred for a particular year
2. Forward sales to a particular seller before the project has commenced
3. The use of futures contracts on climate exchanges to fix the future price of the CERs

Overall, the general consensus by project developers and other key players was that the sale of CERs to international Annexure 1 countries was not an issue. Due to the Kyoto Protocol, there is a defined reduction target for corporations in the first world. As large corporations in the developed world are in a scramble to purchase more credits, CDM developers around the world are finding that demand for credits is out stripping the supply.

"it's not because of lack of demand I mean you can sell a SA CER tomorrow ten times you know so it isn't a demand driven problem it was really a kind of confidence risk amongst managers in SA" – CDM Consultant

As noted in the above quote, CDM project developers did not feel that selling credits is a problem for CDM projects in South Africa. As the largest economy in the African continent, there is demand for CDM credits that are directed towards project developers in the country. There are also various brokerage houses that have now opened up branches in South Africa to allow them to sell South African credits to Annexure 1 countries. A large proportion of the CDM projects undertaken were able to forward sell their credits to Annexure 1 countries and project developers have noted that finding buyers was not a difficult issue.

The Kyoto Protocol has clearly indicated that no projects can be considered as CDM if they are not proven to be 'additional'. The gist of this criterion is that projects must prove in their PDD that the project would not be possible without the generated carbon credits and that the generation of the CERs is the sole reason for the project. Many project participants interviewed have expressed negative opinions with regard to this requirement of the Kyoto Protocol. In a sense, the project is undertaken for CERs but the project developers must prove that the investment in the project would not be possible without the CERs. Many project participants have pointed out that this is a clear contradiction in the Kyoto Protocol. As such, the sale of the CERs is often considered to be a critical part of the project design.

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Without the sale of the CERs the projects are often not economically viable for project developers.

"You know it is not at all uncommon for a project to become viable and unviable several times while you're going through the development stages just because of the carbon price changing."- CDM Project Developer

As noted in the above quote, the price at which the CERs are sold either on the spot market or at a forward contract can change the returns achieved. The volatility of the carbon price adds a layer of uncertainty to any CDM project. Before undertaking a CDM project, the financial estimate of the achievable carbon price is factored into the financial analysis on whether to invest the resources into that project. A sudden drop in the international price of CERs can potentially turn a profitable investment into a loss making investment. As such, the option to enter into forward sales or futures contracts can help mitigate the risk of uncertainty.

"…where you can negotiate a price upfront with a trader or a purchase so that so that at least you've got clarity not so much clarity but you've got you know a risk free income stream that you can bargain on for the future. Otherwise if you simply going to go spot that's a little bit risky." – CDM Developer

The value of any CERs generated from CDM projects is determined largely by the risk inherent in the project. As outlined earlier in the literature review, the lifecycle of a CDM project begins at the project design phase and progressed through validation, registration, monitoring, verification and finally issuance of the CERs. As a CDM project begins to move through this lifecycle the risk of the project falls dramatically. This certainty of the issuance of CERs as the project matures displays an inverse relationship between the risk of the project and the value of CERs sold. Figure 6 illustrates the relationship between the stage in the CDM life cycle and project price that can be achieved.

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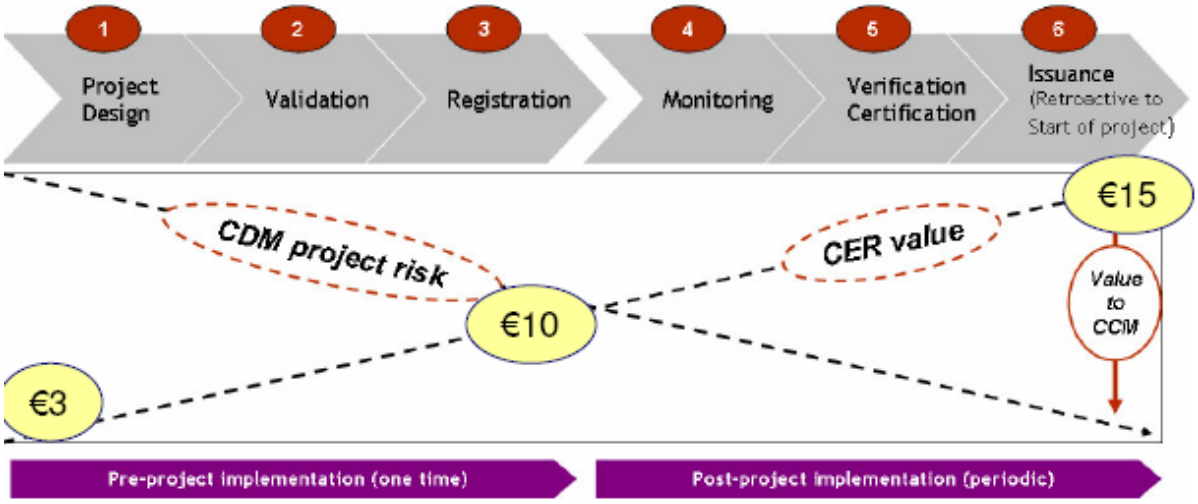
Figure 6



Reference: Kazim, M 2009; Carbon Markets Africa Conference presentation

"I'm hoping that it doesn't run away because it would make cause people to conclude that climate protection isn't affordable so very high carbon price I think is counter-productive but the carbon price sort of between let's say 15 and 30 euro per ton is probably one that will see a lot of projects happening." - CDM Developer

"I think the price will go up to 40/50 Euros. Many people have done calculations about that price and they've kind of said that big solar driven electricity projects could become viable at that sort of price they in fact want that price because it matches the price per ton of installed renewable energy at base load and that's the solution you know to the big world coal problem. So a price of 10 doesn't it's no incentive because you really want the carbon price to subsidize more and more the capital cost of these things. We can't do that in SA because they're not subsidized but they would be if the carbon price was about 40 or 50 Euros"- CDM Developer

As noted above, project participants have noted that the price of CERs is volatile and there are various expectations of where the market will go. A high price will result in making many renewable energy projects viable but it also poses a risk as it may result in governments and corporates merely switching back to pre-Kyoto Protocol type emissions. The price cannot be too low or many renewable projects will not be able to compete effectively with existing energy sources. Rapidly changing political and global economic conditions added into the mix also adds to the relative uncertainty surrounding carbon credits. This uncertainty has helped fuel the volatility in international CER prices.

Of the South African projects registered by the EB, the majority have forward sold their CERs to Annexure 1 countries. Project developers appear to focus on stability of the revenue stream as key to the success of their projects. Over the past decade carbon prices have fluctuated from between €8 to €40 in market trading. This fluctuation of prices makes it difficult for project developers to assess projects to decide whether it's viable. While selling CERs forward results in a price that is below the spot price, the certainty of the revenue stream allows project developers to remove uncertainty from their cash flows. The majority of credits were forward sold to carbon funds or carbon brokers in the United Kingdom, Netherlands and Japan.

The primary reason for the large levels of uncertainty surrounding CERs is the fact that an average CDM project can last over a decade and each year validation needs to occur to allow credits to be verified. There are various costs associated with the running of the projects and the validation process. These fixed costs are cash outflows for project developers and without a certain stream of income the viability of the projects comes under question. In South Africa, of the seventeen projects surveyed, seven projects had a lifespan of 10 years while the remaining ten projects had a lifespan of around seven years. The average reduction in these projects varied from 25,893 CERs per year to 376,060 CERs per year.

The ability of project developers to sell carbon credits does not appear to be an issue as almost all of the seventeen registered projects have been able to forward sell their CERs. The majority of participants have noted that credits were forward sold to an international buyer in order to fund the project. The majority of project developers were simply unwilling

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to bear the risk of a fluctuating carbon price which through its volatility put the entire project under risk of collapse.

Capital budgeting techniques utilised

CDM projects are quite similar to any normal capital project undertaken by a company. It is a valid assumption that all corporate entities have a certain level of capital rationing, whereby the entity's capital is utilized for project that would yield the highest returns for shareholders. Various capital budgeting techniques are employed by corporate entities in order to identify which project will yield the greatest returns for shareholders. The most common of these techniques are the NPV and the IRR.

CDM projects, under the Kyoto Protocol, should only be feasible through the flow of funds from the sale of CERs and should not be feasible excluding the sale of CERs. As such, the financial analysis of projects with and without CERs is critical to the registration of projects. Although no financial measure is indicated by the EB, financial measures were often used by project applicants in their PDDs.

The results of prior research conducted appear to be in line with the responses of CDM project participants. Of the project participants surveyed the primary three methods for assessing whether a CDM project should be undertaken were IRR, NPV analysis and cost analysis. Out of the seventeen projects registered with the UNFCCC seven projects were evaluated using IRR analysis. Only six projects were evaluated using NPV analysis and only 2 were evaluated using cost analysis. Only three projects brought in the use of sensitivity analysis in order to evaluate the viability of the CDM project. Considering the high number of variables involved, the lack of use of sensitivity analysis was surprising.

A project's IRR is the annualized effective compound that makes the NPV of a project equal to zero. IRR is a common financial measure for many financial entities to evaluate whether to accept projects or not. There are various advantages to using this method of analysis. Firstly, the IRR is a simple measure to calculate and is available on most spread sheet and statistical applications. Secondly, the percentage IRR calculated from a project's cash flows is easy to compare to the returns achievable on other projects and, more importantly, can be compared to the required rate of return of the entity. However, various issues exist with using IRR as the base financial measure such as the fact that an IRR can often give irrelevant answers when the cash flows change numerical signs during the time period. Furthermore, it cannot be used to evaluate mutually exclusive projects. Often these issues are ignored due to the ease of calculation of the IRR method.

Six projects implemented in South Africa utilized NPV analysis to conclude on the financial viability of the projects by discounting cash flows to the beginning of the life of the project and assessing whether the NPV is positive. With reference to the above formula, the NPV analysis discounts the net cash flows of a project to a point in time using a discount rate. According to conventional finance theory all projects with a positive NPV should be undertaken. However, NPV analysis is subject to the sensitivity of the variables used to calculate the NPV. Inputs such as the discount rate, the predicted growth rate in cash flows and the selling price of credits all have a major effect on the net value. Slight variations in any of the above variables can lead to a large change in NPV.

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Figure 5, the summary of CDM projects in South Africa, show that the IRR and NPV methods were the most popular of the capital budgeting techniques employed by CDM project developers. The major reason why the IRR was used to evaluate projects was the simplicity of the capital budgeting method. Furthermore, as suggested by other studies, the IRR is already the most used technique in South Africa, with companies preferring that to the NPV method. While traditional finance theory may imply that NPV is the preferred methodology as it can take into account various variables, and does not have an issue with multiple investment rates, or evaluating mutually exclusive projects; the methodology does have practical limitations. Like many other capital projects, a CDM project is subject to many unknown variables. The sensitivity of these variables can have an enormous impact on the final NPV value. As pointed out earlier, the most critical cash flow from the sale of CERs is often unknown at inception of the project before they are sold. Furthermore, inputs such as the impact of the electricity price, tax effects and capital maintenance are also largely unknown. Due to this uncertainty, project participants prefer the simpler IRR method.

The final type of financial analysis used by project participants is cost analysis which is a simple measure of assessing the costs required to undertake the project. This is the simplest type of financial analysis and does not utilize the effects of time value of money and is not comparable to similar projects within the entity.

"...what I can tell you there's typically people who register projects 2,3, 4 years ago didn't plan on the delay that you're now having with verification and so their cash flow will be under severe strain often because of that." - CDM Developer

Surprisingly, the use of sensitivity analysis was minimal in analysing various projects. Any estimation of a project's NPV is based on various factors such the discount rate, the growth rate in revenues and operating costs. A fluctuation in these variables over the life of a project can have dramatic effect on the final NPV value and hence effect the decision on whether to undertake the project. Sensitivity analysis measures the effect of the changes in these and other variables on the project's NPV and IRR (Correria, Flynn, Uliana and Wormald, 2007). The basic way in which sensitivity analysis is carried out is where one variable is changed while keeping all other variables constant. This also allows project developers to understand the risks faced in developing the project and to identify various methods of mitigating the risks involved. For example, if the sensitivity analysis highlighted the fact that the price of CERs generated per year was one of the variables that would have the greatest impact on the value of the project, then a project developer could simply forward sell the credits in order to mitigate this risk. While there are limitations to sensitivity analysis such as the fact that only one variable can be altered at a time or that the analysis does not provide the probability of events occurring, the analysis can be a good method of identifying project risk early on.

Only three out of seventeen projects showed clear analysis of a project's sensitivity to various fluctuations in key variables in the financial models. With many simple tools available containing many spread sheet programs this lack of analysis is glaring. More advanced options such as Monte Carlo modelling were not even considered. This is a weakness in how projects in South Africa are analysed. As highlighted by CDM project developers, extended validation periods, rapid changes in the electricity prices or changes in

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the spot prices of CERs can have a dramatic effect on the value of CDM project. The variability in these factors and the effect on the cash flows of the project should be analysed in order to lower uncertainty around the CDM project and to plan better for variations.

Type of funding utilized

Of the seventeen registered CDM projects in South Africa all of the projects were funded by the project participant's equity financing. Not a single project was funded through external debt financing. This is a striking feature of CDM projects in South Africa and can possibly be a testament to the conservative nature of the financing institutions in lending funds for carbon projects.

"if you go to an institution with a development hat on like DBSA or IDC they will do those smaller projects but the commercial bank won't and the second thing they have to be able to always satisfy is your carbon credits must be registered" - CDM Developer

Financing institutions in South Africa follow international Basel conventions in terms of lending and have traditionally been conservative in their lending practices, only lending to blue chip firms or firms that are able to post sufficient collateral. Firstly, with regard to lending to blue chip firms, this can be seen in the list of project participants that have successfully managed to register projects. Firms such as Sasol, Omnia, PetroSA and SAB are some of the leading Johannesburg Stock Exchange listed companies in South Africa. They all have large balance sheets and significant levels of retained earnings and ability to borrow large amounts of funds to invest in projects. Even with their ability to borrow funds from financing institutions all projects developed by large blue chip companies were funded by internal funding. This indicates that the larger companies have sufficient levels of funds to allow them to undertake projects. As such, firms that could have obtained normal financing did not need to.

"there are 2 conditions that have to be met the one is the project must be of sufficient size and neither of these projects would have been of sufficient size because the commercial banks are slow to look at project finance for less than about R100 million a project in other words maybe the debt will be 70 or so million depending on what the debt equity ratio is but it's a lot of work for them and therefore if it's too small they just not interested."- CDM Developer

As indicated earlier, the largest emitters of carbon in South Africa are Sasol and Eskom, and both have large enough emissions to create hundreds of millions of Rands worth of CERs. However, for small scale developers that are not backed by blue chip large corporate entities the reality of obtaining funding is quite different. Funding institutions such as banks often require collateral for their funds. As the main objective of a CDM project is to obtain CERs through emissions reductions, the net gain of these projects is an intangible product that is both complex and reliant on various hurdles in order to generate cash flows. As CERs are not guaranteed at the onset of a project, lenders have no means of attributing value to this future resource. This presents a problem as banks and financing institutions have no collateral for funds extended. If a large entity requires funding for a CDM project they may obtain the financing from the financing institutions due to the size of their balance sheet.

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However for the smaller players, this is a challenge as they do not have the resources to raise the financing.

"CDM industry is not manufacturing. So that value addition is one of the things the DTI looks at as one of its requirements for a project to qualify as manufacturing."- Government Official

In South Africa large quasi government institutions such as the IDC, the Land Bank and the DTI are focused on the goal of job creation. However, many CDM projects in South Africa are not of a manufacturing or industrial nature which makes it difficult to obtain governmental funding. With banks and other private lending institutions being reluctant to lend to CDM project developers, a natural role for the governmental institutions would be to help finance CDM projects. However, the government organisations have also been reluctant to offer grants or debt funding for CDM projects. The involvement of the government in this area may be a potential solution to the slow uptake of CDM projects in South Africa.

"So you know for a CDM project to fit into the DTI's incentive program it needs to be something that can relate to the requirements of the incentive programs which is mainly manufacturing "- Government Official

"It might encourage CDM if either the DTI or the IDC or any other entity would provide financing. It could be a loan because those people may have the ability to CDM projects have the ability to pay back the loan. It needn't be a grant but definitely upfront financing it could increase the rate of CDM projects being established"- Government Official

The type of funding utilized has a major effect on the effective return of a capital project. As almost all the projects surveyed are funded by equity capital, the amount of leveraged used by CDM projects is, in effect, zero. Traditional finance theory based on the works of Moglidiani and Miller have suggested that the use of debt funding can lower the cost of capital of a project and lead to higher returns (Correria et al, 2007). With traditional financing entities reluctant to extend funds for CDM projects, the involvement of government agencies such as the IDC or the Public Investment Corporation may help extend funds to develop future CDM projects.

While current government policy dictates that public funds be used only in projects that fit into the strategic vision of the country, there exists a potential for the government to include CDM projects into its overall strategic plan. The majority of CDM projects are not large job creators and are not involved in the production of goods for export, but by engaging in CDM projects the government would be encouraging the country to follow a lower carbon growth path.

CDM Market in South Africa

The effect of a power producing monopoly

A major barrier to projects in South Africa is Eskom, the national power producer of South Africa. Eskom is the highest producer of electricity in South Africa and produces over 95% of the country's electricity and around 45% of the total electricity consumed in the African

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continent. During the 2010 financial year the company produced 232,812 GWh of electricity and had 46,018 km of distribution lines in place, which served over 4.5 million customers. Eskom also plans to expand its current power producing capacity by another 80,000 MW by 2026 (Datamonitor, 2010). Given the above, the monopolistic power of Eskom is apparent in South Africa. The government of South Africa is the sole shareholder of Eskom and thus the government has a vested interest in maintaining the monopoly power of the entity. Furthermore, the high costs of entering the market to compete against an established monopoly further deter any new entrants into the market.

In South Africa, as there is only one major purchaser of power, the prices that Eskom pays independent power producers is below the cost of productions. This is a major barrier to CDM developers that wish to set up alternative energy projects. Without the ability to sell electricity generated at a fair market price, the projects are unable to proceed further as it becomes economically unviable even with CERs.

"The problem is Eskom and the RED's and the other people involved in this whole energy story we still have to have those regulations written. I mean we got the legislation there but the regulations aren't in place so in fact you can't sell any electricity to Eskom currently because there are no regulations written yet."- CDM Developer

"there's a lot of CDM that can happen in the next year or two if the REFIT is solved which is a policy barrier"- CDM Developer

Without a credible policy for the purchase of power from independent power producers, the market for CDM projects will be stunted as there are less viable sources of revenue for such projects. With Eskom planning a further 7,000 MW of capacity (Schussler, 2008) through coal based generation methods, the capacity for alternative energy suppliers to the Eskom grid becomes both diminished and further discourages new enterprises in alternative energy by entrepreneurs.

Secondly, a larger problem exists in the form of low electricity costs present in South Africa. Eskom is one of the lowest cost producers in the world. According to Solidarity, Eskom is the 8th cheapest producer of power in the world (Schussler, 2008). The major reasons for the low rate of power are the low cost of coal, which is in abundant supply in South Africa, and the cheap cost of transport to the power stations (Schussler, 2008). Both these factors are not predicted to change in the foreseeable future. A significant portion of South Africa's economy comes from mining exports and thus the encouragement of mining investment is a major focus of the government. A low price of electricity supports this industry and there will be significant pressure not to change the status quo. This low pricing strategy makes it hard for independent power producers and renewable energy producers to enter the market as they cannot achieve the required economies of scale to lower their costs. Therefore, the price at which they can produce power will be higher than Eskom and as a result the price charged to the end user will be higher. The end result of this is that consumers of electricity in South Africa will be reluctant to buy power from any producer other than Eskom. In addition to this, a low cost of power reduces the incentive for industrial and even residential users to reduce their power usage which discourages the use of more efficient technologies.

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"we've got now the challenge there is that Eskom has 20 year old power plants they are currently selling electricity below their cost so for a new independent power producer to come onto the market and try and compete let alone with a renewable energy is impossible."- CDM Project Developer

"The big thing is that if we are going to progress to a low carbon economy we've got to do something about coal. So you've got to start focusing on what do you do to dismantle the coal industry and put an alternative industry in place" – CDM Consultant

In South Africa the price of electricity is around 0.15 USD/GJ while in developed nations this figure is closer to 2 USD/GJ. Government has tried to curb the power of Eskom by introducing NERSA. Eskom is not allowed to simply increase the price of electricity without approval from NERSA which determines a regulate price through a process called a MYPD process (Generation Communication, 2007). However, like all government regulations in place, the process is slow and often geared towards political intentions. When the ruling party in South Africa came into power in 1994, one of its main objectives was the delivery of cheap electricity to the previously disadvantaged classes. As such, the price of electricity is a crucial political lever. The government has, since 1994, had very little price increases in the subsequent financial years. Thus corporations and individuals are accustomed to cheap power and the move to alternative energy producers faces a barrier in the existing power supply.

However, in September 2009 Eskom applied to the regulator for price increases of 45% each in three years followed by smaller increases in the following five years (Ingelis and Pouris, 2010). These price increases have been tabled to NERSA for approval and while lower price increases have since been approved, there appears to be a significant trend upward in the price of electricity going forward. While interviewees have noted the low price of electricity as a barrier to entry for CDM projects in South Africa, going forward this may weaken if substantial price increases by Eskom result in industrial users either seeking energy saving schemes or purchasing power from independent and renewable power producers.

Lack of air pollution regulation

Many participants also cited the lack of regulation in terms of environmental law for the reduction of carbon emissions as a major hurdle for project developers. Corporate entities are not willing to implement costly projects if the status quo does not demand a change in the actions of the corporate player. South Africa currently has environmental law provisions that regulate the effect of human industries on nature. Therefore, there are specific regulations governing the pollution of water, the dumping of waste and the destruction of natural habitats. However, unlike the Annexure 1 countries, there is no regulation that limits the amount of carbon expelled into the atmosphere that is enforced either by the South African government or the Kyoto Protocol. This lack of an incentive to reduce emissions and to become more efficient results in corporate entities not undertaking carbon mitigating projects. Neither is there sufficient voluntary demand for lowering carbon emissions from the public. Furthermore, due to the fact that the majority of emissions emitted in South Africa come from the national power producer through coal fired power plants, there is no incentive for the government to implement strict laws regarding carbon emissions. Without

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strong regulation, there is weak incentive for private entities to engage in carbon emission reduction projects. This lowers the demand for CDM projects.

Skills in South Africa

The skills shortage in South Africa has been highlighted in the literature review. The lack of skills in South Africa was posed to many project participants and key players with some very interesting responses.

The general skills shortage in South Africa is a well-known problem with the root of the structural unemployment being the poor education system. This problem was highlighted by the fact that the South African unemployment rate is exceptionally high, in the range of 27% to 35%, and the level of growth in the economy is not reducing this jobless rate which indicates that structural unemployment is the real issue (Fields, 2000).

"No I think there's enough people who could do the job for the number of projects that there are"- Private Player

"I think we have some extremely knowledgeable consultants in CDM possibly not enough of them but I think what's keeping us back is not CDM specific knowledge I think it's more general skills shortages in SA."- CDM developer

CDM projects are complex and require expert advice and experience in the development of projects. While the structural unemployment facing South Africa and the lack of skills in the general population is a key challenge for the country, project participants have indicated that there are sufficient skills in the country to produce quality projects.

"You can bring someone in from London you can bring somebody in from Germany or the US or whatever for that period do a skills transfer run the project and get them off and the verification and on-going work can be done by SA" - CDM Project Developer

The vast majority of projects are developed by large listed entities such as SAB, Sasol and Omnia who have large sources of funding which allow them to use CDM consultants in order to develop projects and, if necessary, import the required skills from abroad. Large international consulting firms such as Eco Securities and Carbon Stream Africa have opened up offices in South Africa. In addition to this, local consultancies such as CDM Africa and Promethium Carbon have also entered the market with resources to enable CDM project developers to register their projects. Many project participants also indicated that consultants such as the above mentioned were used in their projects in order to register the projects and sell their generated CERs. The availability of skilled consultants means that project specific skills are in supply.

"I think we have a lot of quite a number of people with really good background in terms of CDM. In terms of projects and how to implement it yes I think we have people that can do that. I don't think it's a resource problem in SA as such I think it's a resource problem within the UN and then within the DOE that's where most of the problems lie" - CDM Project developer

The lack of skills appears to be not on the project development side but rather with the registration process. The EB is a panel of international representatives that are assigned the

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task of validating CDM projects that have been proposed by project developers. The EB are the approved member body internationally to the Kyoto Protocol that can approve these projects and as such there is a bottleneck in the approval process. The EB comprises twenty members who are responsible for the validation of all new CDM projects. The board was not proper designed for the sheer volume of projects presented. Each individual project has to be assessed and each methodology has to be interrogated for validity. In this context the amount of time and resources available to fulfil its role is meagre in comparison to the vast amounts of projects applying for CDM status from around the world.

"I think the skills problem is more of a consequence of a lack of those types of projects rather than a lack of the ability for people to do them." - CDM Project developer

In terms of the basic laws of supply and demand, as more projects have been registered by the EB in South Africa and demand for more projects grew, the more expertise became available for further projects. Furthermore, expertise in the carbon markets is available internationally. No project participants surveyed indicated a lack of skills as a key issue in the lack of growth of CDM in South Africa.

Project developers have suggested that the creation of new CDM projects would increase the amount of people with CDM specific experience. In line with basic laws of economics the demand for skills will be matched by the supply. While this may not be true for general skills, this appears to hold true for specific skills.

"It was very much an entrepreneurial driven project in that CDM Africa basically put the thing together" – Project Participant

"But I think almost the way it works is that if you can it's almost stimulating these entrepreneurial guys who are prepared to do all that whereas for an organization it's actually very hard because particularly in the absence of major incentives to do it and I'm not talking about CDM because CDM's not an incentive really" – Project Participant

The effect of the DNA and the EB

A critical part of any CDM project is the approval by the DNA and the EB. As regulatory approval is fundamental to the CDM project being able to sell its CERs, timing delays in granting approval of projects can have a major effect on the cash flows of a project. A significant amount of funding is usually tied up into the initial phases of developing a CDM project and thus a delay in approval by the local entity or the international EB can cause a delay in the issuance of CERs causing financial difficulty for project developers. This is a fundamental risk to CDM projects and may be a factor that has slowed the development of CDM projects.

"But I think at the moment from a project developer's perspective the system is too slow and too difficult." - CDM developer

"there's a large bottleneck at international level but you know I mean in terms of their own rules it says if I recall that registration takes place within 30 days and typically they used to

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say that you know getting all the admin done before that could take 10 or 15 days and that has now been known to take 4 or 5 months." - CDM developer

Often observers are quick to point to poor implementation by the South African government for lack of success in a particular field. African governments are often labelled as being incompetent or lacking the skills to implement large scale projects. However, in South Africa, the majority of project participants have indicated that the government, while not perfect, is not the true cause of the lack of uptake in CDM projects in the country.

Typically project developers will prepare their PDDs and give it to the local government and DOE for approval. Once approval is given on a local level the project has to be sent to the EB for final approval. However, even if a project is evaluated at this level only a small percentage of the submitted projects are approved. Often the EB requires additional documentation or changes to the methodologies implemented. These changes result in further delays to the project developer.

"…obviously the system wasn't built to deal with this volume of projects and it's been much more successful than anybody anticipated and therefore it's very very difficult to cope with the number of projects."- CDM Developer

"The main problem is I think a lack of appreciation of just how much rigor is necessary in the monitoring report to satisfy both the DOE and then finally the Executive Board."- CDM Developer

"No it's the bureaucracy by the Executive Board and because they are insisting on this incredible rigor the Designation Operation Entities the DOE's are passing that on to the various projects as well." – CDM Developer

Once projects have been authorised in South Africa by the DNA the length of time to approve at an international level has been a major delay in getting projects off the ground. South African project developers have cited this bottleneck as a major cause for many CDM projects not getting off the ground. The general consensus among project developers is that the EB was simply not designed to handle the large flow of projects that require approval. When the Kyoto Protocol was implemented the designers of CDM did not envision that the EB would have to screen such a large level of projects or that the number of project methodologies would vary by such a high degree. This has led to inadequate resources being allocated to the EB by the UN. The level of rigour demanded by the UNFCCC is extremely high in order to maintain the validity of a carbon offset program. As such, each project that is examined by the EB is scrutinised intensely and project developers have to allocate a large amount of resources to put their PDD's together. These detailed documents are examined in detail by the EB and this takes a large amount of time. This results in a large delay from the time that the project is ready to be deployed to when the project is finally approved by the EB.

Many CDM developers in South Africa have noted that the South African government has done a satisfactory job in trying to promote CDM. Of the project participants surveyed, only a minority were of the opinion that government was doing an inadequate job in promoting CDM in South Africa. That being said, many project developers feel that there are further steps that the government could take in order to promote the carbon market in South Africa in general.

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"…I'm not saying the only delays are international …there are processes within SA that can be speeded up."- CDM Developer

"Look the government has set up the necessary infrastructure. I'm not sure that one would expect government to do more than that it's really for projects to determine whether they are viable or not and then to go and find the necessary funding"- CDM Developer

As noted above, the institutional delays are caused mainly by the EB and not the South African government. While the local processes can be optimised, there is not much that the South African government or project developers can do about delays at the EB level. This is perhaps an issue that could be looked in at the next conference of the parties.

A key area where the government of South Africa can help with the implementation of CDM projects is the issue of developing infrastructure for independent power producers. South Africa has two large carbon emitters in the form of Sasol and Eskom, with Eskom being the only large scale power producer. As such, any alternative energy producer that would like to produce power has to deal with Eskom. However, due to the large levels of coal inherent in the geology of South Africa, the price of power is one of the cheapest in the world and is a natural reason for the mining and large smelting companies to situate their production facilities in South Africa. This has meant that alternative energy producers and CDM developers, whose projects generate electricity, are unable to compete with the low cost of electricity. This has been highlighted as one of the investment barriers that are faced by CDM project developers in South Africa. Government has delayed in implementing a program for stimulating the alternative energy sector through off take agreements with Eskom. Until there is a way for alternative energy users and CDM developers to sell their excess electricity to Eskom this will be another barrier to entry.

Government has to expedite this process through NERSA by implementing an equitable feed in tariff for independent power producers. As the power grid of South Africa is majority powered by coal power plants, any incentive to independent power producers would help promote the use of green energy and lower the country's dependence on coal. This will also bring the country in line with its LTMS to permit it to grow on a low carbon path. The government has a key role to play in this regard and by encouraging alternative energy projects, the government would also be endorsing the uptake of CDM projects.

"No I don't think it was the government that was the problem it was definitely promotion and knowledge and a sort or risk adverse attitude in business and I think the inherent complexity of the CDM. Whereas other countries like India and China I think they're very different but they would've a lot of the opportunities were taken up at a small scale but never implemented. Here you'd really only find the bigger fish going through the net."- CDM Consultant

As noted above by an interviewee, the government may have set up the necessary infrastructure but there may be a greater role that it can play by encouraging a wider range of entities to participate in CDM projects. Project participants have noted that the South African business environment regarding green projects is generally risk averse and very cautious in investing in new projects such as CDM. The number of smaller players who risk investing in CDM projects is far less than in other emerging markets such as India and China. As noted in the introduction, the effect of this is clear with the other emerging market countries registering thousands of projects as opposed to the handful by South Africa. The

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fact that many of the projects registered by the emerging markets have been small to medium scale indicate that this may be an area of focus for the South African government in accelerating the implementation of CDM in South Africa.

Taxation and financial reporting implications of the CDM projects

Taxation

One of the key questions posed at the onset of this study was the impact of taxation on the origination and implementation of CDM projects in South Africa. As pointed out earlier, the CDM project development cycle is very similar to a normal capital expenditure project. Capital projects are accepted based on returning positive capital returns for the limited capital available. In many projects the effect of taxation can often result in accepting or rejecting a particular project. Tax rates of 28% on corporate entities can have a major effect on the net return realised by capital projects.

A capital project in South Africa is able to attract various tax allowances that add value through reduction of a company's overall taxation charge. All capital projects receive either capital allowances per S12C or wear and tear allowances per S11e in the Income Tax Act. These provisions allow project developers to deduct a portion of the value of their capital investment for tax purposes over a period of time. In order to promote the investment in capital project, the government of South Africa has given larger tax deductions to capital projects. By allowing large deductions in the early years of a project's life, the project is able to reduce its tax burden allowing it to increase its IRR and NPV. In addition to these allowances, further special allowances for strategic industrial projects and manufacturing activities also exist. In the case of certain industrial projects SARS has offered even larger deductions to stimulate further investment. Sections such as S12G and S12I give substantial deductions for taxpaying entities that undertake strategic industrial projects (Income Tax Act; 2010). These deductions add significant value to a capital project and can improve the returns achieved.

Therefore, the deductions and allowances offered to CDM project developers could possibly have an effect on whether the investment decision is taken. As many CDM projects require investment in various types of capital equipment, the existence of such allowances would encourage them to invest in such cash flow intensive projects.

A potential concern to project developers was the tax treatment of CERs received. If carbon credits received for CDM projects from Annexure 1 countries were exempt from South African tax or faced a lower tax rate then this would have a similar effect as generous deductions on the capital expenditure. Project developers would be encouraged to undertake CDM projects as the revenues associated with them would be free of taxation. This is potentially another area in which the South African government could possibly look to encourage further development of CDM projects.

SARS has since proposed two sections to help with the taxation of CERs. The tax authorities have drafted S12K of the Income Tax Act which exempts all certified emissions reductions received by CDM projects in South Africa. In addition to this, S12L has been proposed to allow special deductions for energy efficiency projects and S23G of the Income Tax Act allows for special deductions for the purchasing of equipment that will help reduce the environmental damage of the manufacturing activities incurred in the production of income.

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"There are a number of factors that will influence ownership ok and among them are things like who's paying for the rent, who's paying for the project, what is their relationship to the facility that they are using" – Law expert

At the time of preparing this paper, the government was still in the phase of finalizing its policies on carbon emissions and related carbon credits. In addition to the special deductions and exemptions mentioned above, SARS is also mooting a carbon tax on heavy industrial users. In a paper by Winkler and Marquad (2009), the authors examined the impact of a carbon tax on the South African Economy and the LTMS of the country. The authors concluded that the use of a carbon tax would be an effective mitigation option for the country in relation to the other options such as cap and trade. The impact of a carbon tax on industrial users in the future may be another factor encouraging new CDM projects to come online as industrial users look to lower their carbon footprint.

The above being said, the majority of market participants did not view the tax implications as a major strategic decision. The carbon credits generated from the CDM projects are currently being treated as 'capital' in nature which allows them tax exempt status. This is a boost to the NPV and the IRR on the project as no tax is payable on the cash flows. The majority of CDM projects undertaken in this country have been by large parastatals and corporate for whom the tax advantages were a minor consideration due to the large scale of projects undertaken by them.

"…taxation laws amendment because effectively what it says is that certified omission reductions the carbon credits from CDM projects in SA will not be subject to income tax prior to 31 Dec 2012…"- Law expert

The majority of project developers interviewed highlighted the fact that while tax deductions and exemptions are now in place, at the time of development there was very little legislation in order to encourage the development of CDM projects, as such this was not a major factor in considering whether to undertake a project or not.

Financial Accounting

The impact of financial reporting was also examined in the set of questions posed to project developers and CDM participants. The way that CERs are reflected on the balance sheet and income statement of project developers could impact the overall financial results of the entity developing the CDM project. The issues arise around how to best reflect the CERs on the balance sheet and when the revenue from the sale of CERs should be recognised on the income statement.

In terms of IAS1 of IFRS, an asset is recognised once the entity has control over the future economic benefits that are derived from that resource. With CERs this is difficult to quantify as the asset is an intangible that has economic rights purely due to an international agreement that is ratified by an independent panel. As such, a CER that is generated from a CDM project can only be recognised when the entity has the risks and rewards associated with the ownership of that asset. This may only occur once the EB panel has verified the DOE audit of the annual credits. As this process can take some time, project participants may be forced to not recognise the CERs on their balance sheet.

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In a similar argument as per IAS18, revenue can only be measured once the risks and rewards of ownership of the credits have been passed to the CDM developer and the entity has performed all of its obligations in attaining the CERs. This been said, again the issue is when are the credits actually earned. While emissions are reduced throughout a period, the CERs are only issued after a crediting year. This results in revenue from CDM projects being recognised unevenly and being dependent on external parties. This uncertainty has an impact on reported earnings and adds volatility to the earnings of the company.

In terms of IFRS, there is not a clear method for the accounting for the generation and utilization of CERs. As South African companies are exempt from the emissions targets of Annexure 1 countries, these CERs that are generated can be seen as assets that will generate future economic benefits. Whether the CERs should be classified as a receivable or a financial instrument is an argument that will have to be clarified by the international accounting standard setters. However, it would appear that the generation of the CERs at the end of each year of validation results in an asset that must be shown on the balance sheet of the project developer. As the intention of many of these project developers is to trade the CERs for a profit, the classification of the assets may be as financial instruments that are subject to fair value movements in the statement of profit and loss. As such, the movement of carbon prices would affect the value of the CERs reflected on the balance sheet and the gain/loss that would be shown in the income statement.

In interviewing CDM project developers and participants the financial reporting implications of CDM projects were not regarded as a factor. CDM projects in South Africa are initiated by large industrial players that have large balance sheets and are not affected by the accounting treatment of the carbon credits. The size of the projects and resultant CERS did not have a material impact on the financial results of the large entities that have undertaken CDM projects in South Africa. Furthermore, the majority of project participants surveyed were people from a technical background of engineering or sciences and thus the impact on the financial reporting of the project developer was not a major concern when developing projects.

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Discussion around possible solutions

The initial research question posed enquiries into the development of CDM in South Africa and the issues around why South Africa lags behind its international developing counterparts. The results have been quite interesting in the sense that the normal and often cliqued problems associated with South Africa do not appear to be the issues. The key people involved in CDM in South Africa have indicated that issues such as a skills shortage, lack of government involvement and the inability to sell the product were not the issues holding back CDM development in South Africa. As these usual suspects are not to blame, the question of how to improve the current situation must be posed.

Two key factors have emerged from the research conducted that may indicate possible ways of speeding up the development of CDM projects in South Africa. A key point is the need for entrepreneurs to drive the development of CDM in South Africa. While the large carbon emitting corporate entities have undertaken to develop CDM projects, no real middle class of small and medium projects was developed. This is a key differentiator between South Africa and the other developing nations such as China and India. In those countries, thousands of projects were developed by entrepreneurs and as a result a far greater amount was registered. In promoting smaller scale projects South Africa overall may be able to share more in the revenues being earned globally for carbon projects.

Secondly, in analysing projects undertaken, it is evident that the majority of projects have been funded by equity. This is partly due to factors such as the reluctance of traditional financing houses to extend credit due to the lack of credit and the fact that the majority of projects were undertaken by large corporates who had sufficient internal funding. These two areas are examined in greater detail below.

Development of Entrepreneurs to drive CDM

A key difference between South Africa and other emerging markets engaging in CDM is the number of projects registered. South Africa has seventeen projects in total in comparison to the thousands developed by India and China alone. In the detailed interviews with project developers and CDM experts it is apparent that in other emerging countries the government has both propagated the benefits of CDM and encouraged small and medium scale projects. While the government of South Africa has provided the infrastructure for CDM projects and disseminated knowledge on the topic, there appears to have been little work done in order to promote smaller scale projects.

As highlighted above in the results section, the South African government has had mixed success in promoting CDM in South Africa. Many of the participants feel that the government has done the basics and that the issues relating to the slow uptake in projects in the country can mainly be attributed to investment barriers and the bureaucracy of the EB. Participants in CDM projects have indicated that while the government has set up the infrastructure to register CDM projects, further efforts could be applied in order to encourage entrepreneurs to take up potential CDM projects.

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Of the projects registered in South Africa, many were achieved through innovative small consulting companies that were able to bring the concept of CDM to large industrial players. The size and bureaucracy of large players has meant that many of the projects registered in South Africa would not have happened without the help of smaller entities. This is further evidenced through examination of the PDDs that are registered on the UNFCCC website, where project participants listed alongside the host party are often smaller consulting firms that have the required expertise to allow the registration of these projects.

It is clear that large organisations whose stakeholders have not defined a clean energy pathway as a strategic goal, will not often pursue these types of opportunities. Smaller players with expertise and experience must be encouraged by government and industry so that they may source further projects in the country. This may be the largest differentiating factor between South Africa and its developing peers, India and China. Both China and India have far greater amounts of projects registered but this may also be due to the fact that far larger amounts of smaller scale projects were presented to the EB for validation.

The South African government has highlighted job creation and promotion of manufacturing activities as key to its economic growth plan. However, CDM projects in South Africa are mostly not in the manufacturing sector and often do not create employment or the production of key products for export. As such, CDM has not been a focus of the central government plan.

Government needs to give CDM in South Africa more focus by channelling greater funds to seed smaller projects across the country. As indicated in the results section, the majority of funding came in the form of internal equity finance. The use of debt financing has been glaring absent. Given the reluctance of national banks to fund such projects, the government may have a vital role in stepping into fund smaller projects. This will also help the government push its long term mitigation plan into place.

CDM experts have outlined that the major difference between South Africa and other emerging markets is the fact that India, China and Brazil have a culture of entrepreneurship that has led to many small scale projects being developed and promoted. The sheer volume of the projects has resulted in these countries registering far greater amounts of projects than South Africa. While CDM is inherently complex and tedious in the process required to get projects registered and credits validated, the other large emerging nations have taken to this challenge by encouraging small projects to get off the ground. In South Africa where we have a few large carbon emitters in the form of Sasol and Eskom, the focus has been on these big players and other large industrial companies. No focus has been directed on promoting the small scale developer and helping them get through the process.

Researchers have pointed out that government involvement can help encourage entrepreneurs and help push projects off the ground. A paper by Aping, Loranth and Morrison (2008) has suggested a “pecking order” of government involvement with entrepreneurs. The authors suggest that the state should concentrate its resources on supporting credit guarantees and that co-funding of projects should be performed only after credit guarantees are in place. Lerner (1999) notes how investment by the US government in 1995 amounted to $2.4 billion in relation to $3.9 billion invested by private enterprise. He

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also notes that this has led to the development of corporations such as Apple Computer, Chinron and Compaq.

Zhang and Maruyama (2000) have pointed out that the government needs to create an enabling environment for project developers of CDM projects. The authors point out that the state needs to foster an education on the topic and to efficiently disseminate information on the topic. Furthermore, the use of funding feasibility studies for identification of CDM projects may be another way of encouraging CDM projects (Zhang and Maruyama, 2000). The government of South Africa can get further involved in both these initiatives. While the DMA has offered workshops and seminars to large industrial players, the state should extend these teaching initiatives to entrepreneurs and smaller industrial entities. This would further disseminate knowledge on CDM to a wider range of possible project developers. In addition to this, the suggestion of Zhang and Maruyama can be adopted by identifying possible CDM projects and performing feasibility studies. Once feasible projects are found, possible developers can then be identified.

The government and appointed ministerial bodies have performed their duties in providing the infrastructure for the registration of CDM projects but much more can be done in order to increase the number of projects registered in South Africa. The research has indicated that the major difference between South Africa and its emerging market counterparts is the large number of small and medium CDM projects registered. The South African government can do its part in increasing the uptake of CDM projects by encouraging smaller industrial players and entrepreneurs to invest in CDM projects.

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Increased use of debt

Traditional finance theory has suggested that projects can be funded through internal funding of the entity, the selling of equity stakes and the lending of cash from finance institutions such as banks and other forms of lenders. The capital structure of the funding for any project can have a direct and meaningful impact on the returns achieved by that project. As such, the choice of funding can often lead to project developers either accepting or rejecting a project.

Equity can be defined as money provided by the owners of a project. This includes retained earnings of the entity or money received from selling a stake in the project to additional shareholders. Debt financing can be defined as funds lent by financing institutions that receive regular payments based on an agreement (Razavi, 1996). The pecking order of funding theory has stated that the use of equity funding is far more expensive than debt funding as shareholder wealth is diluted by selling equity stakes or through the opportunity cost of using internal cash (Correria et al, 2007). Furthermore, the use of debt in order to increase returns to equity holders has been shown in the Moglidiani and Miller papers that showed that debt can be used to leverage the returns accruing to equity holders (Correria et al, 2007).

Razavi (1996) highlights that the use of debt in funding energy and green projects requires a level of innovation and that the use of debt financing has become scarcer in developing nations. He further highlights that since the debt crisis of the 1980's projects of a large scale in developing nations have been viewed with greater scepticism and banks now limit their exposure to such projects across the developing world. In addition to this, the average maturity of loans extended is only in the range of 5 to 10 years, which is far less than the life of an average green project. He suggests that specialised energy funds, and regional development banks may be a solution to this lack of debt extension currently offered to CDM projects.

The results of the research have indicated overwhelmingly that project participants in South Africa have used mainly equity to finance the CDM projects. The lack of financing can be attributed to the lack of security provided by the carbon credits and the reluctance of banks to finance high risk carbon projects. South African banks have a very conservative approach and have proved to be reluctant in lending funds to projects that do not provide them with sufficient collateral in the event of a default.

The use of debt financing can be used to encourage further projects in South Africa as more entrepreneurs will be able to access the funding necessary to start the projects. Currently the vast majority of projects registered in South Africa are by large industrial, listed companies with access to large amounts of equity capital. This deters smaller players from entering the market due to the fact that they do not have access to capital in order to register smaller projects.

As pointed out earlier, the government has a key role to play in providing this key level of financing to allow smaller projects to be registered and developed to the level of other developing nations. Government can get involved by putting political pressure to encourage

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the banks to lend money to CDM projects or by guaranteeing a minimum value of credits once the projects have successfully been validated. The extension of government guarantees can have the effect of encouraging private financiers to extend financing to CDM developers in South Africa.

Another option would be to create a green fund that would invest exclusively in CDM and other green energy projects. As pointed out in the earlier chapters, government institutions such as the DTI and IDC are focused exclusively on manufacturing industries that have the capabilities of increasing job creation and exports. While many CDM projects have been undertaken by industrial users, they often do not fall into the defined ambit of a manufacturing activity stated by the parastatals. This results in no support or funding being provided to directly help projects get off the ground. As such, a green fund could help finance projects specifically in this sector and help smaller developers implement projects.

Razavi has suggested that debt can make up 60% to 80% of a conventional capital project. He suggests that this debt financing can also be obtained from international finance corporations, regional development agencies, and government guaranteed loans from multilateral institutions (Razavi, 1996). The role of government to further enhance projects is highlighted by Merna and Nijru (2002), who state that the role of the government can be as:

- Co-sponsor of a project in a private public partnership
- Contribute either an equity or debt stake
- Guarantee any loans undertaken by the project
- Give preferential access to resources controlled by the government
- Be the preferred buyer of any output of the project
- Provide additional fiscal incentives such as tax exemptions and subsidies

In addition to this, the researchers have noted that the involvement of development agencies will lend credibility to the project undertaken leading to other financing institutions to extend debt financing (Merna and Nijura, 2002).

Alternatively, various funding options exist for CDM projects that are currently not being utilised by project participants. One such option is the use of securitisation to allow for the sale of CERs to investors. Various carbon projects can be grouped together to allow the sale of CERs to investors. Depending on the stage of development of the projects involved the price of the CERs can be changed for the appetite of the investor. In addition to this difference, tranches of CERs can be created in order to allow investors of varying risk levels to participate in funding the CDM project. Thus far no projects in South Africa have undertaken this route in order to fund their project and this might be another innovative way of raising funding.

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Conclusion

CDM was designed in the 1999 Kyoto Protocol in order encourage developing nations to embrace a lower carbon path to industrialisation than developed nations. The challenge of tackling climate change has been described as one of the biggest challenges facing our generation. The mean temperature of the planet has steadily increased over the past century and the effects of this change in our environment have been apparent. The implementation of CDM is a key driver of for the Kyoto Protocol and has been undertaken by large emerging countries such as Brazil, China and India. While these countries have registered thousands of projects, South Africa has managed to only register seventeen projects. This paper undertook to analyse some of the strategic issues facing CDM projects in this country. The research questions were formulated in order to gain an understanding of the CDM market in South Africa and the strategic issues facing it.

"I think there's a big future still for project based emission reductions."- CDM Developer

Various questions were asked regarding:

- The investment barriers for CDM projects
- The level of skills available for the implementation of projects
- The type of financing chosen for the projects
- The effect of government intervention
- Financial accounting and taxation issues surrounding CDM projects

These questions were posed to key participants in the CDM market namely project developers, academics, consultants, legal experts and government officials. Through in-depth interviews the research questions posed were answered and the research was able to distil the strategic issues facing CDM in South Africa.

As outlined in the results and recommendation section, the development of CDM in South Africa has been hampered by various issues. The following are the key findings of this research paper.

The South African government has performed its duties by providing the framework for CDM developers to register the projects. The majority of participants interviewed have indicated that the government has performed adequately in promoting CDM in South Africa. The government has undertaken various road shows to improve the market knowledge of CDM and its processes. The country has also developed a DNA that has helped review and submit projects to the EB of South African projects. The capacity of the government to handle CDM project submissions appears to be adequate with the majority of participants commenting on the fact that the government was not a hurdle in the application process.

A critical point of many key participants in the CDM market in South Africa was the bureaucracy of the EB. A worrying problem is the bottleneck created at the executive committee of the UNFCCC. The EB comprising of 20 individuals have to approve all projects that are presented for validation. This is no simple task considering that thousands of projects with various methodologies are presented on a monthly basis. Clearly the EB was

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not designed to handle the large volumes of project submissions and this has created a bottleneck for projects.

Key market participants have also pointed out that the government of South Africa has done only the basics in setting up the infrastructure for CDM projects in country. This paper has pointed out that the government could possibly be more involved in the development of CDM through the development of small and medium projects that could be developed by entrepreneurs. Currently the existing projects have been developed by large parastatals and corporates while in other emerging countries a large number of projects have been developed by entrepreneurs. This could be a key area for the government to help stimulate the market in South Africa.

Another question that this paper chose to address was the impact of the skills shortage in South Africa on CDM projects. Participants indicated that there is no shortage of skills in developing CDM projects as there are sufficient consultants in the industry and the registration of new projects would have drawn further experts into the field. As pointed out in the literature review, South Africa has a critical general skills shortage which has been hampering the growth of the economy. This was cited as a key constraint on CDM projects in South Africa. However, in examination of the responses from the interviewees, it is apparent that this is not necessarily a barrier to CDM projects.

Project developers point out that there are specialist consultancies that are either able to do the work or bring in international help. The majority of projects undertaken in South Africa have been by large corporate entities that have had the financial resources to bring in CDM expertise if needed. The lack of general skills in South Africa is not really a constraint on the development of CDM projects. Furthermore, the experts interviewed felt that further expertise would arise naturally as more CDM projects got off the ground.

An examination of the projects registered in South Africa show that all were funded with equity capital and no debt, implying that funding is not necessarily the issue that faces CDM developers in South Africa. The large corporates who had undertaken CDM projects had access to traditional funding but still chose to fund their projects with equity due to their large balance sheets. The lack of debt financing may be a hindrance to smaller project developers who may not have the luxury of a large balance sheet. Project developers that were interviewed have suggested the traditional debt financing that is available to normal capital projects are often not extended to CDM developers. The major reason for this is the lack of collateral available as a guarantee for the bank's funds that are extended. As CERs have to be approved by the DOE and the EB there is a risk for the financiers that the credits may not be approved. Lending funds on such uncertainty is against the bank's current lending practices. As such, the involvement of government in helping extend finance may be a way of increasing the amount of CDM projects being developed in the country. This could be achieved either through government finance agencies or through a public private partnership with the major financiers whereby the government would play a surety type role in the financing arrangement.

The research results also indicate that there is sufficient scope for growth in the level of CDM projects in the industry if smaller scale entrepreneurs were encouraged. In addition various finance companies are providing innovative methods of raising finance. This will

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allow more companies to register for CDM projects that may not have the financial strength of the larger companies. The use of debt may stimulate the growth in CERs being pushed onto the global market.

Of the project participants surveyed the primary three methods for assessing whether a CDM project should be undertaken were IRR, NPV analysis and cost analysis. Out of the seventeen registered with the UNFCCC, seven projects were evaluated using IRR analysis. Only six projects were evaluated using NPV analysis and only 2 were evaluated using cost analysis. Only two projects also brought in the use of sensitivity analysis in order to evaluate the viability of the CDM project. There appears to be scope for more advanced financial analysis methodologies such as Monte Carlo simulations to be used. Another suggestion raised by the paper has been the involvement of government through the identification of potential projects and the facilitation of feasibility studies for entrepreneurs.

The national electricity producer, Eskom, has been identified as a barrier to CDM projects in South Africa. The low cost of electricity has contributed to making all alternative energy projects almost redundant. Eskom and the abundant supply of coal in the country have resulted in the low cost of electricity that is an investment barrier to clean energy projects. With one of the world's lowest electricity costs demand for alternative energy is low. Adding to this problem is the fact that Eskom is the sole producer of power in the country and the only owner of the national power grid; which has resulted in a barrier to alternative energy producers to sell their electricity. Project participants have highlighted the inability of the national electricity price regulator to implement an appropriate purchasing agreement for independent power producers. This is another area of CDM in South Africa that the government and development agencies could potentially look at.

The majority of key CDM market participants noted that the effect of taxation and the application of international account rules was not a major factor in the decision to develop a CDM project. The project participants noted that the effects of taxation had an effect on cash flows but due to the large nature of the entities undertaking the projects the effect of taxation was minimal.

While strategic issues exist and there are barriers to doing CDM projects in South Africa, there is potential for South Africa to engage in many more projects and to participate in the growing global carbon credits markets.

Future research areas

Further areas for future research include investigation into the possible effects of taxation on CDM projects in South Africa; the pricing of CERs in forward sales; and new financing methods. While there is significant doubt over the CDM as we draw nearer to the 2012 Kyoto Protocol deadline, there is much speculation that the parties to the Kyoto Protocol will either extend the CDM lifeline or create a more efficient replacement for the program. The reality of climate change has been pressed upon all world leaders. A program such as CDM is required to help push developing nations such as South Africa on a more efficient and cleaner growth plan. Without it, countries wishing to industrialize and grow will continue to push carbon intensive solutions in order to meet their development targets.

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Annexure

Annexure 1

Party	Quantified emission limitation or reduction commitment *(percentage of base year or period)*
Australia	108
Austria	92
Belgium	92
Bulgaria*	92
Canada	94
Croatia*	95
Czech Republic*	92
Denmark	92
Estonia*	92
European Community	92
Finland	92
France	92
Germany	92
Greece	92
Hungary*	94
Iceland	110
Ireland	92
Italy	92
Japan	94
Latvia*	92
Liechtenstein	92
Lithuania*	92
Luxembourg	92
Monaco	92
Netherlands	92
New Zealand	100
Norway	101
Poland*	94
Portugal	92
Romania*	92
Russian Federation*	100
Slovakia*	92
Slovenia*	92
Spain	92
Sweden	92
Switzerland	92
Ukraine*	100
United Kingdom of Great Britain and Northern Ireland	92
United States of America	93

* *Countries that are undergoing the process of transition to a market economy*

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Annuexure2

Registered Projects in South Africa

Registered	Title	Other Parties	Reductions **
29-Sep-06	Rosslyn Brewery Fuel- Switching Project		100941
29-Sep-06	PetroSA Biogas to Energy Project	Germany	29933
15-Dec-06	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Canada Netherlands Finland France Germany Norway	68833
06-Mar-06	Lawley Fuel Switch Project	Netherlands	19159
12-Feb-07	Tugela Mill Fuel Switching Project	United Kingdom of Great Britain and Northern Ireland	55912
25-May-07	Sasol Nitrous Oxide Abatement Project	Switzerland United Kingdom of Great Britain and Northern Ireland	960322
20-May-07	Mondi Richards Bay Biomass Project		184633
19-Oct-07	Transalloys Manganese Alloy Smelter Energy Efficiency Project	Switzerland United Kingdom of Great Britain and Northern Ireland	55044
27-Apr-07	EnviroServ Chloorkop Landfill Gas Recovery Project.	Japan	188390
27-Aug-05	Kuyasa low-cost urban housing energy upgrade project, Khayelitsha (Cape Town; South Africa)		6580
05-Nov-07	Project for the catalytic reduction of N2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd ("AEL"), South Africa	United Kingdom of Great Britain and Northern Ireland	116779
08-Feb-08	N2O absent project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa	United Kingdom of Great Britain and Northern Ireland	265460
03-May-07	Omnia Fertilizer Limited Nitrous Oxide (N2O) Reduction Project	Netherlands United Kingdom of Great Britain and Northern Ireland	473338
18-Jul-08	Kanhym Farm manure to energy project	Netherlands	32660

Annexure 3

Interview questions

1. What do you think are the potential problems with the current implementation of CDM in South Africa?
2. Is the government doing enough to facilitate the implementation of CDM?
3. What do you think are the possibilities of an emission trading system in South Africa?
4. Is there enough financing for possible CDM projects? What constraints are placed by financiers of the projects?
5. What will be the effect of tax legislation proposed by the treasury?
6. Are carbon taxes on emissions the way forward? Or should there be special provisions for CDM projects? Such as special allowances or exemptions.
7. How do you think financial reporting standards are affecting the implementing of CDM? Are the accounting rules too stringent for flexible reporting of the CDM projects?
8. Is the pricing of the CERs efficient and transparent?
9. Under what mechanism are CERs transferred to the international market?
10. Are CERs generated under CDM completely fungible with EU ETS credits and JI credits?
11. What are your price expectations for the future?
12. What was the breakeven price for your project?
13. What outcomes from the Bonn conference do you see?
14. Has the sustainability criteria, defined in Kyoto, been met in regard to projects implemented in SA?
15. Are the projects in SA meeting the additionality criteria as specified in Kyoto?
16. What sectors do you see CDM benefiting the most?
17. Do you see a feedback system being implemented by Eskom for the energy generation projects started by CDM?
18. Does South Africa have the necessary skills to implement further CDM projects?
19. What are the chances of implementing a global emissions trading system? What are the benefits of having such a system and what barriers exist for the creation?
20. Do you think there is enough market knowledge on CDM amongst the large firms in South Africa?
21. How efficient is the project approval process in South Africa? Is the DNA efficient in this process? How efficient is the Executive Board with issuing of CERs?

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